LLNL Environmental Restoration Division Standard Operating Procedure	TITLE: Sampling for Tritium in Ground Water
APPROVAL Date _____ _____ Environmental Chemistry and Biology Group Leader	PREPARERS: S. Gregory and E. Walter REVIEWERS: R. Brown*, T. Carlsen, E. Christofferson*, V. Dibley, B. Failor*, B. Hoppes*, G. Howard, and B. Ward*
APPROVAL Date _____ _____ Division Leader CONCURRENCE Date _____ _____ QA Implementation Coordinator	PROCEDURE NUMBER: ERD SOP-2.9 REVISION: 2 EFFECTIVE DATE: December 1, 1995 Page 1 of 9

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1.0 PURPOSE

To define the procedures for the collection of ground water samples for tritium analysis that are representative of the aquifer of interest.

2.0 APPLICATIONS

This procedure applies to the collection of water samples to be analyzed for tritium.

3.0 REFERENCES

3.1 Taffet, M., J. A. Oberdorfer, T. M. Carlsen, W. R. Dugan, and R. S. Mateik (1990), *Remedial Investigation of the Building 850/East Firing Area, Lawrence Livermore National Laboratory Site 300,* Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-ID-104335).

4.0 DEFINITIONS

4.1 Grab Sample

A grab sample is one in which no well purging has been conducted prior to sample collection.

4.2 Tritium

Tritium is in the form of tritiated water, in which one hydrogen atom (sometimes two) in the water molecule has been replaced with the tritium isotope. Thus, tritium is considered a conservative contaminant, because it will not volatilize (fractionate) or change activity appreciably upon contact with the atmosphere (Taffet et al., 1990).

5.0 RESPONSIBILITIES

5.1 Division Leader

The Division Leader's responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

5.2 Field Personnel

The field personnel are responsible for properly performing ground water tritium sampling in compliance with all applicable regulations and procedures.

5.3 Sampling Coordinator (SC)

The SC's responsibility is to ensure that the field personnel comply with all pertinent SOPs related to routine tritium sampling.

6.0 PROCEDURE

6.1 Office Preparation

6.1.1 Prior to commencement of field activities personnel shall review the appropriate Site Safety Plan, OSPs, and all applicable SOPs. Current copies of the documents shall be retained in the sample vehicle at all times.

6.1.2 Review all pertinent sampling information such as, the quarterly Routine Sampling Schedule and Well Specification Table provided by the SC.

6.1.3 Obtain appropriate data collection forms, i.e., Chain-of-Custody (CoC) forms, Ground Water Sampling Logs from SOP 2.1, "Presample Purging of Wells," Attachment A, and assigned field logbook.

6.1.4 The number and type sample containers necessary for sampling should be obtained from the SC's supply. The type of analysis for which a sample is being collected determines the type of bottle, preservative, holding time, and filtering requirement (SOP 4.3, "Sample Containers and Preservation"). The SC replenishes sampling supplies from the contract analytical laboratory (CAL) or LLNL stores. For sampling wells containing low turbidity ground water, 40 mL

VOA vials can be used. Up to 1 L may be necessary if the water is highly turbid. Glass containers should be used when collecting tritium samples. Questions concerning the appropriate container should be directed to a QC chemist.

6.1.5 Field personnel should check sampling supplies (i.e., bottles, filters, etc.) and inform SC when the supply is low. Field personnel may reorder from the CAL or LLNL stores.

6.1.6 Field personnel should notify the SC when collecting interlaboratory collocated samples, so that arrangements can be made with the CAL courier for sample pickup.

6.1.7 Check all equipment for proper operation including the gasoline generator to be used with the dedicated electric submersible pumps. Wear gloves at all times when handling any gasoline engines.

6.2 Field Preparation

6.2.1 Check with the Building Supervisors for area access per SOP 4.1, "General Instructions for Field Personnel." The Administrative Escort Services must be given a 24-hour notification before work is scheduled in restricted areas at Site 300.

6.2.2 Assemble all necessary supplies, packing materials, and appropriate sampling equipment. Load into the field sampling vehicle. Refer to Equipment Checklist (Attachment A).

6.2.3 Decontaminate any nondedicated equipment that will be used per SOP 4.5, "General Equipment Decontamination."

6.2.4 Locate monitor wells to be sampled and choose most efficient sampling order. Sample from areas with the lowest tritium activity to the areas with the highest activity, if possible.

6.2.5 Fill out any initial information in the Document Control Logbook per instructions in SOP 4.2, "Sample Control and Documentation."

6.3 Operation

Tritium samples are collected in a number of ways. Tritium is one of the few contaminants that can be collected from a monitor well using grab sampling methods. If the well contains a dedicated bladder or electric submersible pump, only enough presample purging is done to remove all stagnant water residing in the discharge line of the pump. Presample purging is not necessary prior to tritium sample collection. However, many of the monitor wells do not have dedicated purging/sampling equipment. For these wells, samples are collected using a manual bailer or by attaching a sample container to the probe of an electric water level indicator.

6.3.1 Sample Collection with Electric Submersible Pump or Bladder Pump

The collection of tritium samples using these two devises is consistent with that described in SOP 2.3, "Sampling Monitor Wells with Bladder and Electric Submersible Pumps." As mentioned previously, the only exception is that presample purging (with the collection of indicator parameters) is not necessary. When using the electric submersible pump, purge 4 to 5 gal prior to sample collection to remove stagnant water from the discharge line. Only 1 to 2 gal need

to be purged if a bladder pump is used. Collect and treat water per SOP 4.7A, "Livermore Site Treatment and Disposal of Well Development and Well Purge Fluids," or SOP 4.7B, "Site 300 Treatment and Disposal of Well Development and Well Purge Fluids."

6.3.2 Sample Collection with Bailer

Manual bailing (including bailer construction and use) is described in SOP 2.4, "Sampling Monitor Wells with a Bailer." This procedure is generally followed in sampling for tritium in ground water, except that no presample well purging is necessary.

6.3.3 Sample Collection with Water Level Indicator

Attaching a 40 mL VOA vial to the probe of an electric water level indicator with a polyethylene cable tie is a simple means of sampling for tritium. Since tritium sampling is usually conducted concurrently with water level measurement, it saves time to do both simultaneously. The water level measurement is obtained as discussed in SOP 3.1, "Water Level Measurement."

A. Uncap and attach a clean sample container to the probe of the water level indicator using a polyethylene cable tie. The container should be attached about 3 to 4 in. from the tip of the probe so that an accurate water level measurement can be obtained before the container is allowed to fill. Refer to SOP 3.1 for specific instructions on measuring water levels.

B. Slowly lower the probe and sample container into the monitor well. After the water level measurement is obtained (SOP 3.1), lower the container further so it will fill completely, and then slowly reel the probe and container back to the surface.

C. Detach the container from the water level probe and properly dispose of the cable tie. Direct disposal questions to the appropriate Environmental Analyst or Hazardous Waste Management personnel. Cap the container and then rinse the outer surface with deionized water into the collection barrel adjacent to the monitor well. Clean the water level indicator as discussed in SOP 3.1.

D. Immediately label the sample container, place into a air tight plastic bag, and store in a cooler containing double-bagged ice (refer to SOP 4.3, "Sample Containers and Preservation").

E. Record all sampling information (e.g., well ID, method of collection, and date) per SOP 4.2, in the Document Control Logbook. Also, circle the "yes" column on the water level measurement/tritium sample log to indicate that a tritium sample was collected (Attachment B).

6.4 Post Field Operation

6.4.1 Prior to leaving the site, cross check the samples collected with the tritium sample log.

6.4.2 Ensure that all necessary information is recorded in the Document Control Logbook and complete a CoC form per SOP 4.2.

6.4.3 Thoroughly decontaminate all equipment that is not dedicated (SOP 4.5).

6.4.4 Verify that the CoC is appropriately completed per SOP 4.2. Indicate any special instructions in the Remarks Section of the CoC. Such instruction may include filtering and preserving the sample upon receipt. Also, for wells that are listed on the sampling plan as Clean Wells or for any well that is expected to be free of contamination write, "Verify any positive detections and call _____." The blank should be filled in with the appropriate QC Chemists name and phone number.

6.4.5 Follow SOP 4.4, " Guide to the Handling, Packaging, and Shipping of Samples." Ship the samples daily or at the completion of the sampling event. If samples are going to be stored for a long period of time, place in a lockable refrigerator or box where custody can be maintained.

6.5 Office Post Operation

6.5.1 Deliver all field logbook notes, ground water sampling logs, and CoC forms weekly to the SC. Deliver or fax copies of completed CoCs daily to the SC.

6.5.2 The SC will retain a copy of the original forms (CoC, ground water sampling log), and provide the originals to the Data Management Group (DMG) for final archive. The DMG will provide copies of the forms to the appropriate Operations and Regulatory Affairs Division Analyst, as necessary.

7.0 QA RECORDS

7.1 Logbooks

7.2 Field sheets

7.3 Chain-of-Custody form

8.0 ATTACHMENTS

Attachment A—Equipment Checklist

Attachment B—Water Level Measurement/Tritium Sample Log

Attachment A

Equipment Checklist

Equipment Checklist

____ Generator
____ Two-way radio
____ Water-level indicator
____ Indicator refence bar
____ Polyethylene cable ties
____ Ziploc-type bags
____ 40 mL VOA vials or other appropriate glass sample containers
____ Coolers
____ Deionized water
____ Document control logbook
____ Tool kit
____ Disposable latex gloves
____ Snake chaps (if necessary)
____ Squirt bottle
____ Field sheet
____ Detergent soap
____ Pencils, pens
____ Sample labels
____ Paper towels

Attachment B

Water-Level Measurement/Tritium Sample Log

Well designation	Shiner elevation	POM elevation	Top of fixed structure	Tritium sample collected	
K1-01C	1074.08	1076.08	2.00	Y	N
K1-02B	1105.11	1107.11	2.00	Y	N
K1-03	1105.93	1107.93	2.00	Y	N
K1-04	1119.88	1122.55	2.67	Y	N
K1-05	1128.74	1130.74	2.00	Y	N
K1-06	1088.59	1090.59	2.00	Y	N
K1-07	1098.92	1101.92	3.00	Y	N
K1-08	1120.58	1122.60	2.02	Y	N
K1-09	1124.58	1126.58	2.00	Y	N
K2-01C	1049.19	1051.19	2.00	Y	N
K2-03	1064.64	1066.64	2.00	Y	N
K2-04D	1089.52	1092.52	3.00	Y	N
K2-04S	1088.95	1091.95	3.00	Y	N
K7-01	1317.02	1319.02	2.00	Y	N
K7-03	1336.09	1339.09	3.00	Y	N
K7-06	1410.95	1413.95	3.00	Y	N
K7-07	1295.02	1298.02	3.00	Y	N
K7-09	1342.10	1344.77	2.67	Y	N
K7-10	1340.64	1343.31	2.67	Y	N
K8-01	1098.44	1100.44	2.00	Y	N
K8-02B	1125.42	1128.42	3.00	Y	N
K8-03B	1096.89	1099.89	3.00	Y	N
K8-04	1130.14	1133.15	3.01	Y	N
K8-05	1130.44	1132.45	2.01	Y	N
K9-01	1072.51	1075.51	3.00	Y	N
K9-02	1133.39	1135.39	2.00	Y	N
K9-03	1114.42	1117.08	2.66	Y	N
K9-04	1081.95	1084.62	2.67	Y	N
NC2-05	1032.89	1034.90	2.01	Y	N
NC2-05A	1032.93	1035.46	2.53	Y	N
NC2-06	1032.17	1033.51	1.34	Y	N
NC2-06A	1032.94	1034.27	1.33	Y	N
NC2-08	1050.67	1052.67	2.00	Y	N
NC2-07	765.07	768.07	3.00	Y	N
NC2-09	1032.81	1035.48	2.67	Y	N
NC2-10	1038.44	1040.71	2.27	Y	N
NC2-11D	1025.62	1028.62	3.00	Y	N
NC2-11I	1025.76	1028.76	3.00	Y	N
NC2-11S	1025.52	1028.52	3.00	Y	N
NC2-12D	1025.44	1028.44	3.00	Y	N
NC2-12I	1025.75	1028.75	3.00	Y	N
NC2-12S	1025.52	1028.52	3.00	Y	N
NC2-13	1018.49	1021.50	3.01	Y	N

DRY = No water was detected in well casing at time of measurement.
NA = Information not available at this time.
TOSP = Top of stove pipe.

Attachment B. Water level measurement and tritium sampling log.